

Ecological Drought in the South Central United States

Time is not on our side

South Central Climate Science Center Workshop
March 29–30, 2016
Norman, Oklahoma

The Department of the Interior Climate Science Centers (CSCs) and their managing organization, the National Climate Change and Wildlife Science Center at the U.S. Geological Survey, have chosen the emerging climate science field of Ecological Drought as a research focus area. There is currently no working framework for drought-induced ecological impacts, and drought planning capabilities are needed for biodiversity conservation and the ecosystem services that natural areas provide. This workshop is part of a series of meetings at each of the nation's eight CSCs aimed at collating our existing knowledge of the ecological impacts, resistance, and recovery from drought to help chart the way forward for related research activities and management options.

The time to act is now

Drought is not new to the South Central United States. Historically the region has experienced multi-year droughts. However, according to the National Climate Assessment, the region is approaching a new standard of more frequent and severe droughts. The Dust Bowl of the 1930s taught us about conserving soil and water through better land management. However, climate change is bringing new challenges that will require further innovations in land management. In order to protect the unique values and landscapes of the South Central U.S. from the consequences of this new standard of drought, we need to act now.

Diversity under threat

The South Central U.S. is uniquely diverse, stretching across many ecoregions, from deserts in New Mexico, to plains in Oklahoma, to coastal marshes in Texas and Louisiana. Each of these systems relies on freshwater and is sensitive to changes in water availability. While forecasted changes in temperature and precipitation vary across the region, adaptation strategies are necessary to address the needs of both human and natural systems in all parts of the region.

Valuing our scarce water resources

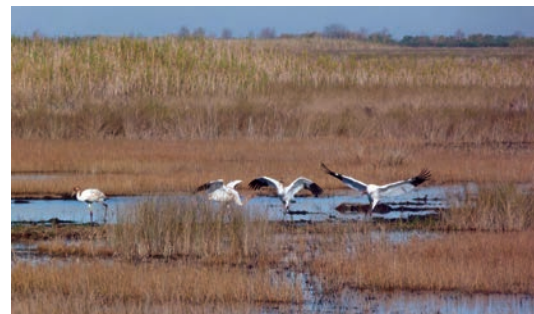
Water remains inexpensive and is often over-allocated in the South Central U.S. Consequently, water is often taken for granted. Innovative education and outreach efforts can help us all to better appreciate the value of water in our region, encouraging efficient use of this essential resource.

Our diverse landscapes require innovative solutions

In the South Central U.S., ecological diversity supports cultural and economic diversity. There are 68 federally recognized tribes in our region, each with their own unique cultures, histories, and political institutions. Our natural resources also sustain a variety of economic activities, from farming on the High Plains to fishing in coastal Louisiana. More frequent and severe droughts are expected to disrupt these cultural and economic ways of life in the near future. Because current drought management strategies will likely be inadequate for addressing these more severe droughts, new approaches are essential. Innovations in drought management must consider the cultural and economic diversity of the region in order to be effective, addressing impacts to first foods and culturally important natural features of our many tribal nations as well as impacts to agriculture, energy, and tourism.



Peggy Greb, USDA



Sara Zimorski, LDWF



Bob Nichols, USDA



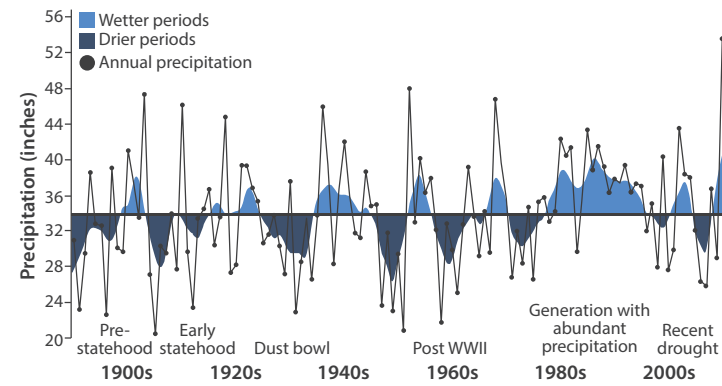
Lance Cheung, USDA

Characterized by variation in precipitation, temperature, and habitats

The landscapes of the South Central United States are characterized by strong gradients in precipitation, temperature, and habitats. The north–south gradient in temperature and east–west gradient in precipitation provide for a variety of ecosystem and land use types throughout the region that are increasingly threatened by drought.

High variability leads to extreme dry conditions

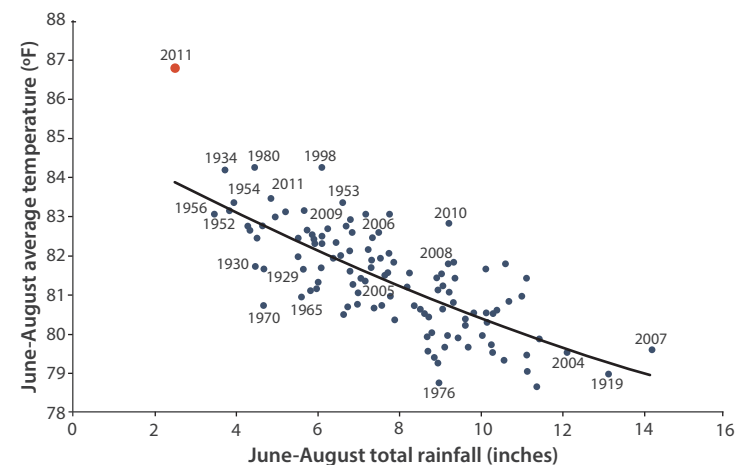
Parts of the South Central U.S. are particularly susceptible to drought. In the arid western half, temperatures often exceed 100°F and months-long dry spells are not unusual. Average annual precipitation is less than 10 inches in northwest New Mexico, which contrasts sharply with the 60 inches or more in Louisiana. In addition, annual water loss from evapotranspiration of plants is higher than annual precipitation. A warming atmosphere is likely to make these conditions more extreme, leading to more frequent and severe droughts in the future.



Since the modern record began in 1895, Oklahoma has historically cycled through wetter and drier periods. Source: Oklahoma Climatological Survey.

Extreme events are outside historic norms

Future climate change projections include increased precipitation in the northern Great Plains and decreased precipitation in the southern Great Plains. These projections are supported by conditions already being observed. For example, spring 2011 was the wettest on record in the north and saw exceptional drought in the south. The summer of 2011 was the hottest ever recorded in the region, with water loss rates twice the average, and record rainfall and flooding.



The 2011 drought set a new precedent for drought conditions in the region. Source: John Nielsen-Gammon, Texas State Climatologist.

Reduced flows affect wildlife, habitat, fisheries, and people

The South Central U.S. area encompasses a wide variety of habitats, each providing resources for the plants and animals of the region. In addition to providing fish and wildlife habitat, the coastal ecosystems of Texas and Louisiana protect coastal communities, support fisheries, sequester carbon, and provide recreational opportunities. These coastal waters rely on freshwater delivered to the coast by rivers to stay healthy.

However, growing coastal communities place increased demands on the inland water resources that feed coastal ecosystems. These demands reduce river flows, increasing the salinity of coastal waters and impacting these productive and sensitive ecosystems. More frequent dry spells may lead to further reductions in the natural resources these systems provide.

Top: Coastal Louisiana marsh monitoring, Mike Osland, USGS.
Middle: Whooping cranes in Texas marsh, John Noll, USDA.
Bottom: Venice, Louisiana shrimp boats, Flickr user Finchlake2000.



Flash droughts require alternative practices

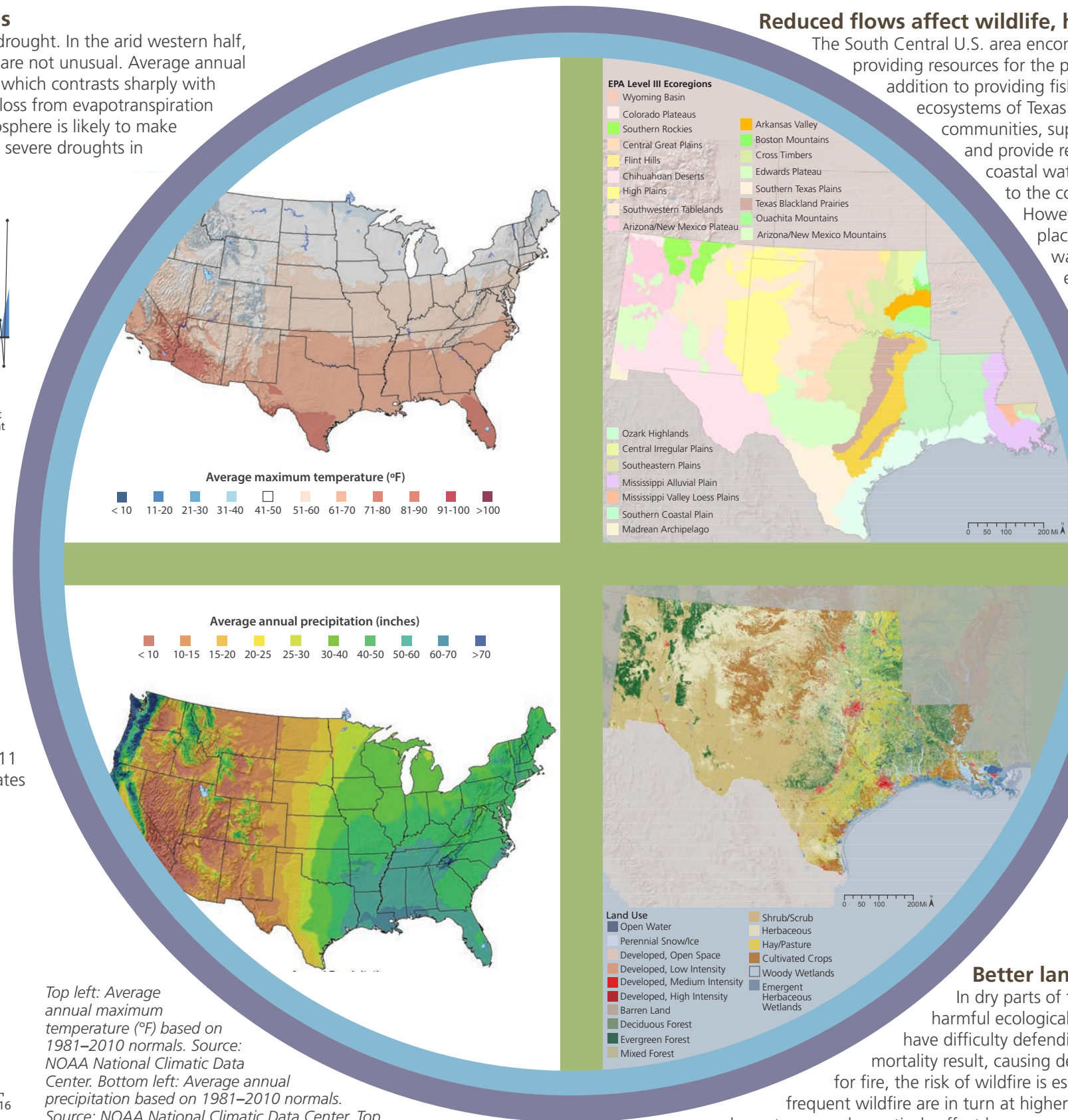
Flash droughts occur when drought conditions intensify rapidly (over weeks rather than months) in the spring and summer. When combined with a lack of rainfall and higher evaporation rates, spring and summer heat waves can lead to sudden, severe drought impacts. Rapid decreases in soil moisture result from these flash droughts, causing detrimental effects on water supplies, agriculture, and ecosystems.



A dust storm approaching Stratford, Texas (April 18, 1935). The dust bowl taught land managers to manage for soil conservation; however, droughts of the future require new and innovative techniques. Source: NOAA.

Better land management to avoid cascading impacts

In dry parts of the South Central region, such as New Mexico, drought can have harmful ecological consequences. For example, trees weakened by a lack of water have difficulty defending themselves against pests like the bark beetle. Higher levels of tree mortality result, causing dead wood to accumulate in forests. Because dead wood is excellent fuel for fire, the risk of wildfire is especially high during drought. Areas that have been impacted by more frequent wildfire are in turn at higher risk for flash floods, which can carry large amounts of loose sediment downstream and negatively affect human and ecological communities. New Mexico's forests and rangelands are of tremendous ecological and economic importance, so protecting them from these cascading impacts of drought is essential. Innovative forest management practices will be necessary to reduce the impacts of more frequent and severe drought.



Top left: Average annual maximum temperature (°F) based on 1981–2010 normals. Source: NOAA National Climatic Data Center. Bottom left: Average annual precipitation based on 1981–2010 normals. Source: NOAA National Climatic Data Center. Top right: EPA Level III Ecoregions within the South Central United States. Source: U.S. EPA. Bottom right: Land use types within the South Central United States. Source: National Land Cover Database.

Planning for ecological drought in the South Central United States

New conditions call for new thinking. We help build new solutions.

The South Central Climate Science Center (CSC) is a regional partnership of researchers, land managers, tribes, and others working collaboratively to develop tools and strategies that address the impacts of climate, including drought. Unfortunately, the more frequent and severe droughts described above are likely to be the new normal. Our partnership is invested in honoring the economic, ecological, and cultural richness that characterizes this region by addressing the harmful impacts of drought. The South Central CSC understands that innovation and collaboration are crucial for accomplishing this goal. That's why we bring diverse partners together to develop and share science that will help communities to successfully plan for a changing climate. Through the South Central CSC, a network of landowners, scientists, and tribal nations is coming together to share knowledge and build a future of resilience and abundance for human and ecological communities.

– Kim Winton, Director, South Central Climate Science Center



Participants at the South Central Climate Science Center workshop held in Norman, Oklahoma in March, 2016.

For more information regarding ongoing research and activities at the South Central Climate Science Center, visit southcentralclimate.org

Workshop participants

Barney Austin, AquaStrategies.
Roger Fragua, Center of the American West.
Bill Bartush, Gulf Coast Prairie LCC.
Caiti Steele, New Mexico State University.
John Zak, Texas Tech University.
Ariane Pinson, U.S. Army Corps of Engineers.
Nicole Athearn, U.S. Fish and Wildlife Service.
Nina Burkhardt, Mike Langston, Michael Osland, Laura Thompson, Kim Winton, U.S. Geological Survey.
Renee McPherson, Mark Shafer, University of Oklahoma.
Dagmar Llewellyn, U.S. Department of the Interior Bureau of Reclamation.

Science communication, layout, and design

Simon Costanzo, William Dennison, Brianne Walsh, University of Maryland Center for Environmental Science

Contributors

Jessica Blackband, U.S. Fish and Wildlife Service

Cover photo

Bob Nichols, USDA



SOUTH CENTRAL
CLIMATE SCIENCE CENTER

